Tactual Discrimination of Household Objects

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Abstract

The young child's concept of space was explored through tactual discrimination of common household objects. The results were analyzed in terms of degree of vision, amount of previous schooling, and sex for the three variables of type of identification required, rooms of the home represented, and degree of familiarity displayed. Results indicated no differences on the basis of vision, schooling, or sex. Type of identification and room categories were both found to differ significantly when tactual discrimination of objects was required. It was suggested that further study of this area might provide an instrument for assessing the young child's school readiness.

Tactual Discrimination of Household Objects

The word "space" immediately conjures up ideas of openness, vastness, emptiness, expanse. For a sighted individual these meanings are frequently based on visual input. Yet, if considered more deeply, space is a feeling that can be imagined even without vision. Space permits a three-dimensional world which may be studied in terms of the relationships among objects. Vision just gives space parameters that confine it for the sighted. Life is conducted within that confined space. Philosophers have discussed and theorized the reality of objects and space; scientists have studied, tested, and attempted to verify the reality of objects and their relationships in space; psychologists have attempted to discover how these concepts and beliefs regarding objects and space develop; but most of us live under the assumption of their reality. Space is a given and objects are real. However, this has remained a relatively unexplored area of development in the visually handicapped. Early researchers in their attempts to understand the relation of blindness to spatial concepts primarily used two approaches. Either they studied the congenitally blind individual immediately after sight was restored by surgical means, or they compared the tactual performance of congenitally blind persons with that of temporarily blinded persons, usually by blindfolding sighted individuals.

Both these approaches had limitations, however. First, the early researchers referred to adults whose sight was restored; yet recent research indicates that for functional recovery, surgical intervention must be performed at very early ages and no later than 2 to 4

years of age (Bouzas, 1955). In addition, much research has been conducted indicating that permanent deleterious effects occur from lack of sensory stimulation during the early years of infancy (Hatwell, 1966; Hebb, 1937; Riesen, 1947).

The second approach was limited in that the sighted, though blindfolded, were not equivalent to their blind counterparts because they retained their memory for visual concepts and experiences (Hatwell, 1966).

Juurmaa (1972) stated that research aimed at understanding spatial notions of blind individuals had moved principally in two directions. First, space had been explored in terms of how various technical aids could improve the blind person's mobility. The second direction had attempted to discover how spatial relationships were or could be mastered on the basis of sense data other than vision without the use of technical aids. At present, as Juurmaa (1972) stated, the first avenue was receiving the most attention (Clarke, Pick, & Wilson, 1975; Foulke, 1971; Schulz, 1972; Swallow, 1973; Worchel, 1951); while the second approach, though rarely employed, contained the greater theoretical and practical potential.

Since spatial concepts are internalized ideas based on actions, the blind child could possibly benefit from early training in how to investigate objects, how to trace edges, how to feel the entire surface in order to construct a mental image, and in general, to be more sensitive to various stimuli in the environment. To accomplish this, more emphasis should be placed on sequential growth and develop-

ment of spatial concepts for visually limited children (Schulz, 1972; Swallow, 1973; Swallow & Poulsen, 1972). But what is that sequence?

With no research available on the development of spatial concepts in blind children, attention turned to what knowledge was available for sighted children. The child's first notions of space were formulated as she/he adjusted actions to reach near or distant objects. Ideas of time were expanded as the child accommodated movements to catch a swinging toy (Copeland, 1974; Flavell, 1963; Kamii, 1971, pp. 281-344; Lovell, 1971; Piaget, 1967; Piaget & Inhelder, 1965; Sauvy & Sauvy, 1974). In the extensive study The Child's Conception of Space (Piaget & Inhelder, 1965) the groundwork was laid for much recent research on spatial concepts. According to Piaget (Hatwell, 1966) mental space was a construction built by the activity of the individual. The construction was the coordination of actions which lead to objective space. He felt that the elaboration of spatial representation depended more on cognitive processes than on purely perceptive ones.

Piaget's and Inhelder's (1965) work found that notions of space in young children began with topological understandings and proceeded into projective and Euclidean concepts (Simpkins, 1978). Through their studies, Piaget and Inhelder (1965) tried to find out how the child represented space, not how space was perceived.

The first topological spatial relation to develop was proximity or "nearbyness." The younger the child was the greater the importance

of this property. As the child grew older, he became able to distinguish or "separate" one object or parts of an object from one another. Building on these ideas, the child developed the property of order, A came before B and B before C. Finally, enclosure or surrounding was recognized. An element (B) was not only between other elements in a series (A and C), but was also enclosed or surrounded by those other elements. Most of these ideas did not become a permanent ingredient of the young child's reasoning until 7 years of age or more (Bass, 1975, pp. 45-70; Copeland, 1974, 1976; Flavell, 1963; Piaget & Inhelder, 1965; Sauvy & Sauvy, 1974). The exception was the spatial relation of continuity which involved the notion of infinity. This was not mastered until the formal level of logical thought (Flavell, 1963). The projective and Euclidean ideas of space achieved equilibrium between 9 and 10 years of age (Copeland, 1974, 1976; Flavell, 1963; Piaget & Inhelder, 1965).

This theory of spatial development was based on research conducted with sighted children. Knowledge of the blind child's concepts regarding space and how that space was organized or mentally represented was not considerable, and generally, was inconclusive. In the tactual realm, the individual recognized objects by successive operations (actions) within the restraints of various spatial relationships. To form a judgment on the basis of these operations, the individual must tactually observe, systematize reactions, and finally, merge the resulting reactions. Just how this was accom-

plished and what types of mental representations were formed by blind children was and is unknown.

Purpose

Recognizing the lack of available information on the development of spatial concepts in blind children, this study hypothesized that the tactual recognition of objects would reveal aspects of elementary spatial concepts in young blind children. Common household objects (Nolan & Morris, 1960) were employed to examine these understandings.

Method

Subjects

Children who were enrolled in both public and private school classes as of September 1, 1977, who had no severe handicapping condition (other than visual impairment), who had either no previous school experience or only 1 year of prior schooling, and who were between the ages of 4 to 7 years were included in the study. Table 1 presents a summary of the sample.

Insert Table 1 about here

Sighted subjects were randomly selected from kindergarten and first grade classes in Philadelphia public school. Blind and partially sighted subjects were selected from classes in the Philadelphia area including southern New Jersey; Delaware; Montgomery County, Maryland; Indiana School for the Blind; Kentucky School for the Blind;

Cleveland, Ohio public schools; and both public day schools and the residential school in Nebraska.

Materials

The Household Objects Familiarity Assessment was based on school readiness tests and studies utilizing household objects with young children. Objects were categorized by rooms in a house (utility, including workshop, laundry, sewing, etc.; living room; bath; kitchen; bedroom; and playroom) and by three levels of familiarity (very familiar, familiar, unfamiliar) for preschool children. In Part A the child's ability to tactually discriminate the same object among three choices was assessed while Part B required discrimination of an object similar to the stimulus from among three choices.

Procedure

Each subject was seen individually for approximately 30 minutes. A preliminary task was given to acquaint each subject with the procedure. In addition the preliminary task determined whether the child knew the concepts of same and different. If she/he did not indicate this understanding, the preliminary task was used to teach the concept. Only when the child met criterion, was she/he included in the sample. The screening box was then introduced and the subject was given opportunity to familiarize her/himself with it. The front panel of the three-sided box contained two cloth sleeves through which the child's hands were placed. Sitting opposite the subject, the experimenter presented the stimulus object to the child for tactual

exploration. Three objects were then placed in a divided tray within the screening box for tactual examination. The child was asked to identify (point, pick up, etc.) the object identical (Part A) or similar (Part B) to the stimulus. Similarity was based on function while differing in some other principal characteristic such as size, shape, texture.

Design

To create the Household Objects Familiarity Assessment, a preliminary item pool was obtained from school readiness tests: the Metropolitan Readiness Test (Hildreth, Griffiths, & McGauvran, 1969) and the Boehm Test of Basic Concepts (Boehm, 1971), from published research articles (Nolan & Morris, 1960; Piaget & Inhelder, 1965; Thomas, 1971; Weiner, 1963), and from professional educators. Objects in the item pool were categorized in terms of the room in which the object would most frequently be found.

In the next step items were prepared for parent rating and were distributed to volunteer parents in the Louisville area. A total of 10 parents of sighted preschoolers and 5 parents of visually impaired children responded by rating each object in terms of its familiarity to their preschoolers.

Ratings were tallied for parents of sighted and visually impaired children separately. Finding few differences between the ratings of each group, a mean was obtained for the total responses for each object. This mean was then used to rank the objects from most to

least familiar. From the ranked list the two highest items became the stimulus objects representing the very familiar category on Parts A and B. The two lowest ranked objects represented the unfamiliar category while the two objects ranked in the medial position were categorized as familiar for the Household Objects Familiarity Assessment.

In scoring student performance, 1 was assigned the correct option; 2 represented the object in the next closest ranked order; and 3 specified the object from the list that might be associated with the stimulus object or in some way be tactually confusable with it. For instance, the stimulus and correct option for one item was soap. The object in the next closest rank receiving the score of 2 was toothpaste. The score of 3 was assigned to a washcloth. A table of random numbers was used to order the presentation of the alternatives for each stimulus and to arrange the sequence of questions for Parts A and B.

Data were gathered on a pass-fail basis for recognition or nonrecognition of an object. Analysis of variance techniques were used to address several questions. Piaget and Inhelder (1965) and others have suggested that tactual skills involved in recognition activities for spatial concepts are developmental and not necessarily taught. However, recently preschool programs have been cited as training such skills as preparation for school. Therefore, school experience was examined to determine effect on performance. Differences in spatial

concepts between males and females were suggested by other studies (Mitchelmore, 1976, pp. 143-184; Taback, 1975, pp. 111-144) while vision was acknowledged as an obviously important variable in development of spatial understandings. An ANOVA (see Table 3) was performed to determine the effect of these three variables on the tactual recognition of household objects. Since no significant differences were found between sexes, the groups were collapsed and additional analyses were performed to ascertain the effects of school experience and amount of vision on (a) the type of identification required (identical or similar), (b) room classification from which the objects were drawn (utility, living room, etc.), and (c) degree of familiarity of the object to young children based on parents' ratings (very familiar, familiar, unfamiliar). Item difficulty was examined by compiling the percentage correct for each item for the sample by vision categories.

Results

The means and standard deviations for each subsample for total correct scores on Household Objects Familiarity Assessment are presented in Table 2. Since the maximum attainable score was 30, the

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Insert Table 2 about here

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relatively high means suggest that the objects were more familiar to young children than had been anticipated by the parents' ratings.

In addition, little difference was found among the subsamples. These preliminary judgments were supported by the statistical analyses.

Initially a 3 x 2 x 2 analysis of variance was performed on the total correct scores obtained on Household Objects Familiarity Assessment (see Table 3). No significant differences were found in per-

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Insert Table 3 about here

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formance on the basis of amount of vision, school experience, or sex. In subsequent analyses sex differences were collapsed but school experience and amount of vision were retained.

Additional analyses of variance examined the relationship of these two variables with each of the three aspects of Household Objects Familiarity Assessment. Table 4 indicates the results of a 3 x 2 x 2

Insert Table 4 about here

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analysis of variance in which the young child's ability to locate an object identical to the stimulus (Part A, $\underline{M}$ = 14.04) or one that was similar to the stimulus (Part B, $\underline{M}$ = 12.23) was observed. The graph presented in Figure 1 portrays the finding that identification of the same object was easier than locating a similar object. Again, no significant differences were found between vision groups or school experience groups.

Insert Figure 1 about here

The variables of degree of vision, amount of school experience, and individual room categories were examined by another ANOVA. In reducing the initial length of Household Objects Familiarity Assessment, room items did not remain equivalent. Therefore, scores were transformed to percentages for this analysis (see Table 5). Total maximum scores for each room category were as follows: utility = 6,

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Insert Table 5 about here

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living = 5, bath = 5, kitchen = 4, bedroom = 6, playroom = 4. Despite this inequivalence of scores, a significant difference was obtained when percentages correct for each room were compared. This suggested that whether visually impaired or not, the young child does tactually recognize cbjects from some areas of the home more readily than other areas. Means for percentage correct for each room were as follows: utility = 86.5, living = 86.3, bath = 94.6, kitchen = 73.5, bedroom = 91.4, playroom = 90.6. School experience did not influence significantly the young child's development of tactual recognition skills of objects.

The last ANOVA researched the differences in performance on the basis of degree of vision, amount of school experience, and famil-

iarity of the objects as previously rated by the parent volunteers (see Table 6). No significant differences were found.

Insert Table 6 about here

Item difficulty was probed by obtaining the percentage correct for each question (see Table 7). All subjects performed well and few differences were noted among vision categories. When items

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Insert Table 7 about here

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were difficult (e.g., #23), they proved difficult for all vision categories. When familiarity for the total sample was examined, a slight trend was noted from unfamiliar (85.45%) to familiar (86.53%) to very familiar (90.65%), but it was not as strong as would have been anticipated on the basis of the parents' ratings.

To determine whether subjects more often chose the second option (object in the next closest ranked order) or the third option (object which might be associated or tactually confusable with the stimulus), a tally of incorrect responses by vision category was made (see Table 8). Although sighted and partially sighted children

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Insert Table 8 about here

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showed little difference between options they chose, the blind children tended to choose the third option more frequently than the second.

Discussion

Although the small sample size (N = 4 per cell) and the restricted ranges of responses precludes substantial inferences, tentative conclusions do suggest avenues for further research. In previous studies (Mitchelmore, 1976, pp. 143-184; Taback, 1975, pp. 111-144) differences were found between male and female performance on spatial tasks. The lack of differences in the present study suggests that age may play a part since in both Mitchelmore's (1976, pp. 143-184) and Taback's (1975, pp. 111-144) studies the subjects were older. Differences may develop as the child moves into the concrete operational level and attempts to manipulate spatial constructs.

Another variable affecting the performance of sexes may be the types of tasks used. This conclusion is suggested by the significant difference found in form of identification for Household Objects Familiarity Assessment. Finding the same object as the stimulus required simple tactual recognition. To identify an object similar to the stimulus required not only tactual recognition of the object, but analysis of its primary components which would be found in the correct alternative. The task of analyzing the object, holding particular components constant while inspecting and locating those

components on the alternatives, required greater mental manipulation (Witkin, Birnbaum, Lomanaco, & Herman, 1968). This resulted in a significantly different performance between Part A and Part B.

Other researchers (Ahmad, 1971; Ewart & Carp, 1963; Worchel, 1951) had found little difference among vision groupings when only tactual recognition was required. Likewise, no differences were found between vision groups in this study.

The objects used in Household Objects Familiarity Assessment were simple and very familiar to all the children. Amount of previous schooling seemed to have no effect on the familiarity of the items. The means for each group (see Table 2) supported this conclusion since all means approached the maximum attainable score.

Although it must be interpreted cautiously, the original hypothesis that young children would be more familiar with objects in some rooms than others was confirmed (see Table 5). For instance, it was anticipated that the playroom would produce more correct responses than the kitchen where exploration would be inhibited for safety considerations. Means for correct responses for each room supported these conclusions.

Familiarity of items (see Table 6) resulted in no significant differences. Although 15 volunteer parents had rated the objects for familiarity to preschool children, this sample recognized all items as relatively equivalent suggesting either greater familiarity with objects in their environments or unrealistic parent ratings.

Since preschoolers had not been defined in terms of age for the volunteer parents, they may have assumed a younger age than that represented in the sample. However, even the youngest blind child with no previous school experience surpassed the expected ratings of these parents. In examining the percentage correct for each item (see Table 7), all subsamples found the kitchen most difficult. The least difficult for the blind subjects as well as the sighted subjects was the bedroom where many young blind children spend much time playing, with the bath following as a close second. For the partially sighted the highest correct percentage was found for the bathroom, followed by the playroom. As noted previously, a slight trend was noted for the entire sample from unfamiliar to very familiar.

When incorrect responses were analyzed (see Table 8), the blind subjects tended to choose the object most associated with or tactually confusable with the stimulus while the partially sighted and sighted samples indicated no preference. This might suggest the blind children were attempting to form some type of primitive classification rather than identify a specific object with the same function as the stimulus (Tobin, 1972).

In summary, although less dispersion in performance was found on the Household Objects Familiarity Assessment than had been expected, some conclusions may be made from the results. First, finding an object similar to the stimulus was more difficult than finding the same object. Swallow (1973) has stated that acting on objects is the

foundation for spatial learning. The amount of active handling of an object was seen by Davidson (1972) as critical to the development of accurate judgments of form perception. Active handling isolated and enhanced the components of stimulation which specified the objects and other characteristics being touched. The 4 to 5 year old subjects in this study typically conducted little examination of a form's contour, but by 6 to 7 years they became more accurate. The latter simultaneously grasped the whole figure with all fingers of the hand, isolating leading features of the form and appearing to compare it with all other aspects of the form. Therefore, it was concluded that global or simultaneous exploration was a particular aspect of active handling that bore upon the accuracy in judging the form. An important role of scanning involved the accurate coding of stimulus information for later use. Davidson (1972) concluded that exploratory activity could be modified by experience. However, the child may need to be taught how to trace edges and how to feel the entire surface in order to construct any image at all (Swallow, 1973; Swallow & Poulsen, 1972). From the present study it may be inferred that experience and training developed exploratory techniques since those with 1 year of schooling, although not statistically significant, generally surpassed those with no previous schooling. The importance the role of coding stimulus information played may be inferred also from the significant difference found between the identification of same and similar items.

The differences between room classifications suggested that young children were more familiar with some areas of the home than others. In this sense, a readiness assessment might include some of these items to determine children whose experiential background might inhibit their progress in formal school programs. Tobin (1972) stated that the school frequently was left with the task of identifying the experientially underprivileged when they arrived at school and then of providing appropriate compensatory stimulation.

The fact that there was no difference on the basis of familiarity suggests that a wider range of objects might be useful. Common objects from the home may indicate for the visually impaired child the extent of freedom the preschool child has had to explore and become acquainted with his environment. This, too, could prove an asset in determining the child's readiness for and placement in educational programs. Further study of this area might provide a means for identifying these experientially underprivileged children.

Footnote

Dr. Simpkins was an educational research scientist at the American Printing House for the Blind when this study was conducted. Presently, she is assistant professor in educational psychology at Brigham Young University.

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Table 1

Sample Distribution for Tactual Discrimination of Household Objects Study

N = 48

	No previous schooling ages 4 to 7 years		1 year previous schooling ages 4 to 7 years	
No useful vision (blind)	M	4	M	4
	F	4	F	4
Some useful vision (partially sighted)	M	4	M	4
	F	4	F	4
Useful vision (sighted)	M	4	M	4
	F	4	F	4
		24		24

Table 2

Mean Total Correct Responses by Subsamples on

Household Objects Familiarity Assessment

		0 yrs. schooling ages 4 to 7 years		1 yr. schooling ages 4 to 7 years		Total by vision	
		M	SD	M	SD	M	SD
Blind	M	25.25	2.88	26.50	2.38	25.88	2.57
	F	26.25	1.71	26.50	3.87		
Partially sighted	M	24.50	3.00	28.25	.96	26.06	2.54
	F	26.50	2.38	25.00	2.31		
Sighted	M	26.75	.50	26.75	.50	26.88	2.20
	F	25.25	3.86	28.75	.50		
Total by schooling		25.75	2.45	26.79	2.34		
Total by sex	M	26.33	2.14				
	F	26.21	2.72				

Table 3

ANOVA on Mean Total Correct Responses on

Household Objects Familiarity Assessment

$N = 48$

Source	SS	df	MS	F
Vision (A)	9.04	2	4.52	.76
Schooling (B)	13.02	1	13.02	2.20
Sex (C)	.19	1	.19	.03
A x B	4.54	2	2.27	.38
A x C	1.62	2	.81	.14
B x C	4.69	1	4.69	.79
A x B x C	39.12	2	19.56	3.30
Error	213.25	36	5.92	

Table 4

ANOVA on Mean Total Correct Responses for Method of Identification (Identical-Similar) on Household Objects Familiarity Assessment

N = 48

Source	SS	df	MS	F
Vision (A)	4.52	2	2.26	1.03
Schooling (B)	6.51	1	6.51	2.96
Identification (C)	78.84	1	78.84	35.82**
A x B	2.27	2	1.13	.52
A x C	3.06	2	1.53	.70
B x C	.51	1	.51	.23
A x B x C	.64	2	.32	.15
Error	184.87	84	2.30	

**$p < .01$

Table 5

ANOVA on Mean Total Correct Responses for Room Categories on Household Objects Familiarity Assessment

$N = 48$

Source	SS	df	MS	F
Vision (A)	395.53	2	197.77	.89
Schooling (B)	647.16	1	647.16	2.90
Rooms (C)	13153.10	5	2630.62	11.79**
A x B	263.91	2	131.95	.59
A x C	2459.84	10	245.98	1.10
B x C	972.56	5	194.51	.87
A x B x C	1829.34	10	182.93	.82
Error	56212.16	252	223.06	

**$p < .01$

Table 6

ANOVA on Mean Total Correct Responses for Familiarity Ratings on Household Objects Familiarity Assessment

N = 48

Source	SS	df	MS	F
Vision (A)	3.01	2	1.51	1.20
Schooling (B)	4.34	1	4.34	3.44
Familiarity (C)	6.89	2	3.44	2.73
A x B	1.51	2	.76	.60
A x C	5.15	4	1.29	1.02
B x C	1.05	2	.53	.42
A x B x C	1.65	4	.41	.33
Error	158.87	126	1.26	

Table 7

Percentage Correct for Each Item by Room Categories

Room & Item Number	Blind	Partially Sighted	Sighted	Total
Utility				
1(F)	100.0	93.8	100.0	
7(UF)	87.5	81.3	93.8	
10(VF)	100.0	100.0	100.0	
17(UF)	81.3	100.0	81.3	
21(F)	87.5	100.0	93.8	
22(VF)	43.8	37.5	75.0	
	83.3	85.4	90.7	86.5
Living				
2(F)	75.0	100.0	93.8	
14(VF)	93.8	87.5	87.5	
26(VF)	93.8	100.0	93.8	
28(F)	81.3	100.0	93.8	
29(UF)	62.5	56.3	75.0	
	81.3	88.8	88.8	86.3
Bath				
3(F)	100.0	100.0	93.8	
6(UF)	87.5	87.5	87.5	
8(VF)	93.8	100.0	100.0	
16(F)	100.0	100.0	93.8	
20(VF)	81.3	93.8	100.0	
	92.5	96.3	95.0	94.6
Kitchen				
4(VF)	100.0	93.8	100.0	
5(UF)	93.8	93.8	100.0	
23(F)	18.8	31.3	6.3	
24(UF)	93.8	75.0	75.0	
	76.6	73.5	70.3	73.5
Bedroom				
9(VF)	81.3	81.3	93.8	
12(F)	93.8	62.5	93.8	
15(UF)	100.0	87.5	100.0	
19(VF)	93.8	81.3	93.8	
27(F)	93.8	93.8	100.0	
30(VF)	93.8	100.0	100.0	
	92.8	84.4	96.9	91.4
Playroom				
11(VF)	100.0	100.0	100.0	
13(F)	93.8	100.0	100.0	
18(UF)	75.0	68.8	62.5	
25(VF)	87.5	100.0	100.0	
	89.1	92.2	90.6	90.6

Note. VF = Very familiar, F = Familiar, UF = Unfamiliar

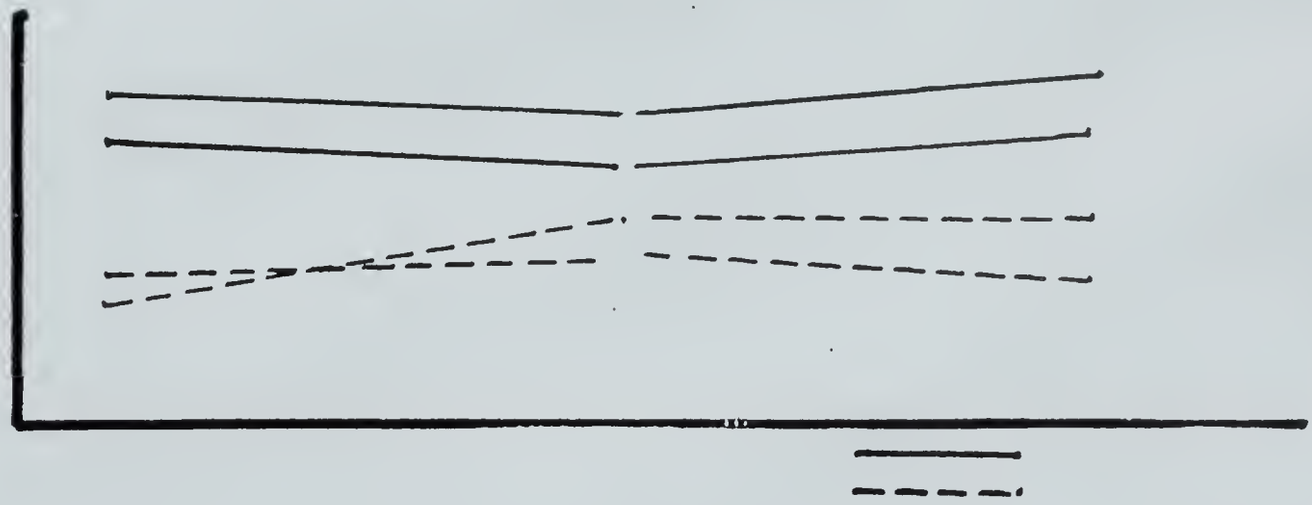
Table 8

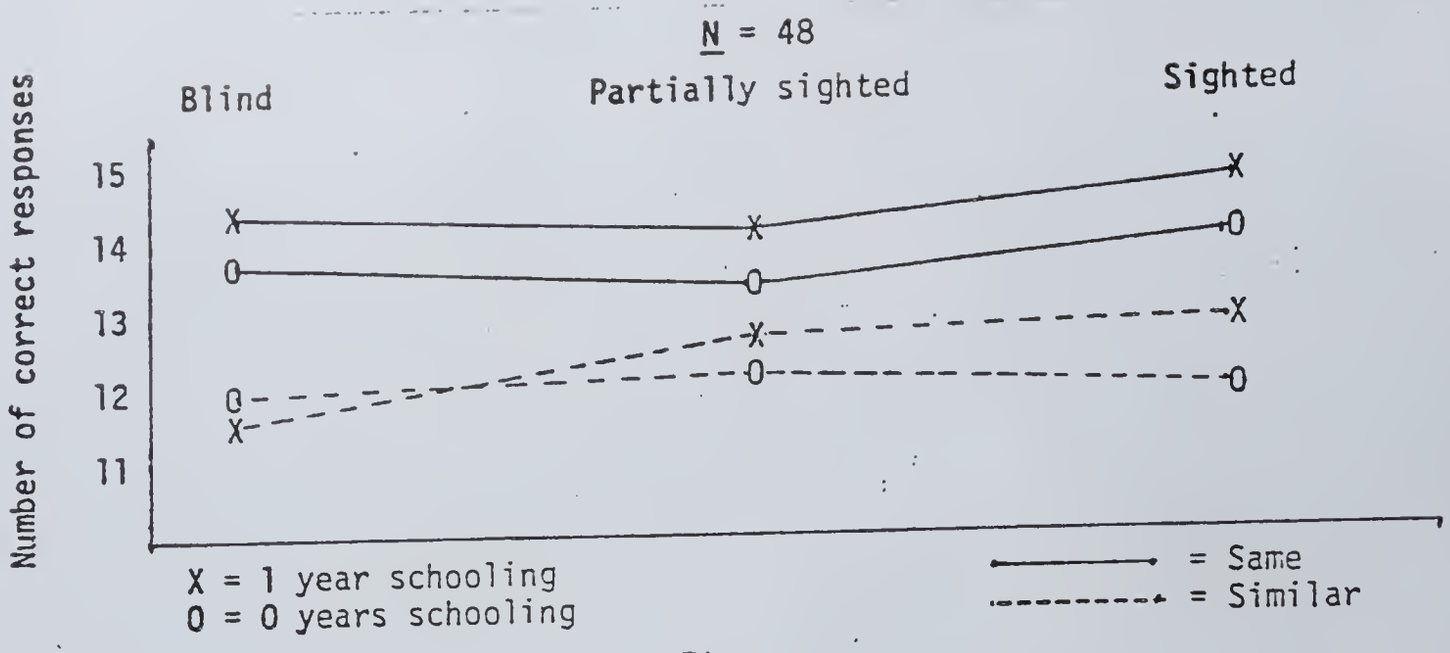
Number of Incorrect Options Chosen by all Subjects and by Item Number

Item number	Option 2			Option 3		
	B	PS	S	B	PS	S
1					1	
2				4		1
3			1			
4		1				
5				1	1	
6				2	2	2
7		2	1	3	1	
8	1					
9	2	1		1	2	1
10						
11						
12		3		1	3	1
13				1		
14	1	1			1	2
15		3				
16			1			
17			1	3		2
18	1	1		3	4	6
19				1	3	1
20	2	1		1		
21	2		1			
22	6	9	3	3	1	1
23	13	11	15			
24		1		1	3	4
25				2		
26				1		1
27		1		1		
28			1	3		
29				6	7	4
30				1		
	28	35	24	39	29	26

Figure Captions

Figure 1. Mean performance for identification on the basis of amount of vision and amount of school experience (maximum score = 15).




N = 48
Blind
Partially sighted
Sighted
Number of correct responses
15
14
13
12
11
X = 1 year schooling
0 = 0 years schooling
= Same
= Similar